ALS20000 / ALS25000 Series

Stage User's Manual

P/N: EDS100 (Revision 1.03.00)

Dedicated to the Science of Motion
Aerotech, Inc.
101 Zeta Drive,
Pittsburgh, PA, 15238
Phone: 412-963-7470
Fax: 412-963-7459
www.aerotech.com

Product Registration

Register online at: http://www.-aerotech.com/prodreg.cfm

Technical Support

United States Headquarters:
Phone: (412) 967-6440
Fax: (412) 967-6870
Email: service@aerotech.com

United Kingdom:
Phone: +44 118 940 9400
Fax: +44 118 940 9401
Email: service@aerotech.co.uk

Germany:
Phone: +49 911 967 9370
Fax: +49 911 967 93720
Email: service@aerotechgmbh.de

Japan:
Phone: +81(0)47-489-1741 (Sales)
Phone: +81(0)47-489-1742 (Service)
Fax: +81(0)47-489-1743
Email: service@aerotechkk.com.jp

China:
Phone: +852-3793-3488
Email: saleschina@aerotech.com

Revision History

Revision 1.03.00	April 5, 2011
Revision 1.02.00	February 28, 2011
Revision 1.01.00	August 26, 2009
Revision 1.00.00	February 10, 2006

Product names mentioned herein are used for identification purposes only and may be trademarks of their respective companies.
© Aerotech, Inc. 2011

Table of Contents

Table of Contents iii
List of Figures v
List of Tables vii

Chapter 1: Overview 1
1.1. Standard Features 2
1.1.1. Optional Features 2
1.1.2. Model Numbers 3
1.2. Dimensions 5
1.3. Safety Procedures and Warnings 6
1.4. EC Declaration of Incorporation 8

Chapter 2: Installation 9
2.1. Unpacking and Handling the Stage 9
2.2. Preparing the Mounting Surface 10
2.3. Securing the Stage to the Mounting Surface 11
2.4. Attaching the Payload to the Stage 13
2.5. Electrical Installation 13

Chapter 3: Operating Specifications 15
3.1. Environmental Specifications 15
3.2. Basic Specifications 16
3.3. Load Capability 18
3.4. Optical Limit Switch 20
3.4.1. Limit Switch Operation 20
3.4.2. Limit Switch Wiring 20
3.5. Standard Motor Wiring 21
3.6. Vacuum Operation 24

Chapter 4: Maintenance 25
4.1. Service and Inspection Schedule 25
4.2. Cleaning and Lubrication 25
4.2.1. Recommended Lubricants and Cleaning Solvents 25
4.2.2. Important Notes on Lubrication 25
4.2.3. Lubrication and Cleaning Process 26

Appendix A: Warranty and Field Service 27

Appendix B: Technical Changes 29

Index 31

Reader's Comments 33

List of Figures

Figure 1-1: Typical ALS2500 Series Linear Positioning Stage 1
Figure 1-2: Typical ALS25000 Stage 2
Figure 1-3: ALS20000 / ALS25000 Dimensions 5
Figure 2-1: Results of Flat Versus Non-Flat Mounting 10
Figure 2-2: Top View of ALS20000 / ALS25000 Stage Showing Hardcover Mounting Screws 11
Figure 2-3: Internal View of ALS20000 / ALS25000 Stage Showing Mounting Holes 12
Figure 3-1: Load Capability of ALS20000 / ALS25000 Series Stages 18
Figure 3-2: Finding LSC for Side-Mounted Stages 18
Figure 3-3: Acceleration vs. Mass for ALS20000 / ALS25000 Series Stages 19
Figure 3-4: Normally Closed (NC) and Normally Open (NO) Limit Switch Wiring 20
Figure 4-1: Top view of ALS20000 / ALS25000 Stage Showing Hardcover Mounting Screws 26

List of Tables

Table 1-1: Model Numbering System 3
Table 3-1: Environmental Specifications 15
Table 3-2: ALS20000 / ALS25000 Series Specifications 16
Table 3-3: ALS20000 / ALS25000 Series Resolution Information 17
Table 3-4: ALS20000 / ALS25000 Motor Specifications 17
Table 3-5: Feedback and Motor Connectors for Stages with LT Square Wave Encoders 21
Table 3-6: Feedback and Motor Connectors for Stages with LT Amplified Sine Encoders 22
Table 3-7: Feedback and Motor Connectors for Stages with LN High Accuracy Encoders 23
Table 3-8: Motor Wiring Pinout Descriptions 24
Table B-1: Current Changes (1.03.00) 29
Table B-2: Archived Changes 30

Chapter 1: Overview

This manual describes Aerotech's ALS20000 / ALS25000 series of linear motor positioning stages. Figure 1-1 shows a typical ALS25000 positioning stage.

This chapter introduces standard and optional features of the ALS20000 / ALS25000 stages, explains the model numbering system, and gives general safety precautions.

Figure 1-1: Typical ALS2500 Series Linear Positioning Stage

NOTE: Aerotech continually improves its product offerings, and listed options may be superseded at any time. Refer to the most recent edition of the Aerotech Motion Control Product Guide for the most current product information at www.aerotech.com.

1.1. Standard Features

The ALS20000 / ALS25000 stages are low-profile, high-accuracy stages for use in production environments where space and contamination are concerns. The ironless linear motor is completely cog-free, allowing for extremely tight velocity control. Due to the ironless forcer and U-channel magnet design, the magnetic field is self-contained.

The ALS20000 stages have a metal waycover to protect the stage from vertically falling debris. The ALS25000 stages have the added protection of side belts to prevent particle ingress in harsher environments.

1.1.1. Optional Features

Cable management systems are available in various configurations depending on the number of axes involved and customer requirements for cables that must run to the stage table. Custom configurations are common and readily available, contact Aerotech for more details.

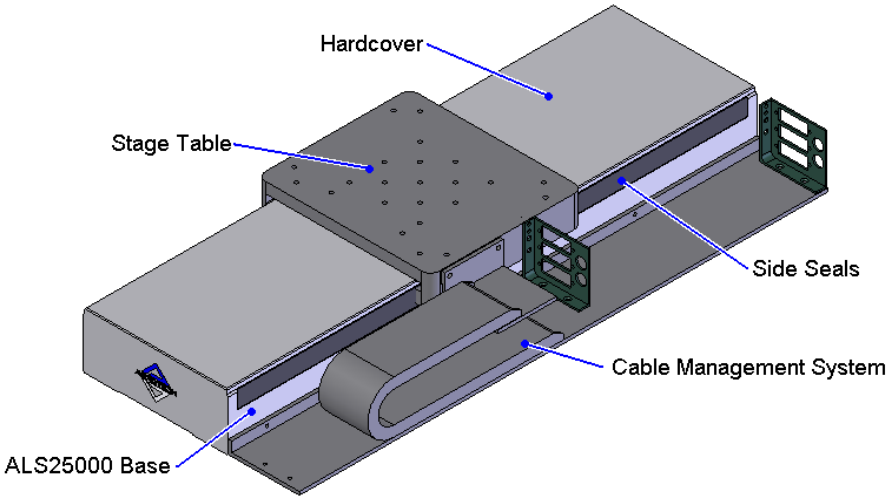


Figure 1-2: Typical ALS25000 Stage

1.1.2. Model Numbers

The stage model number indicates the optional features on a particular stage. To determine the options on your stage, refer to Table 1-1 for an explanation of the numbering system.

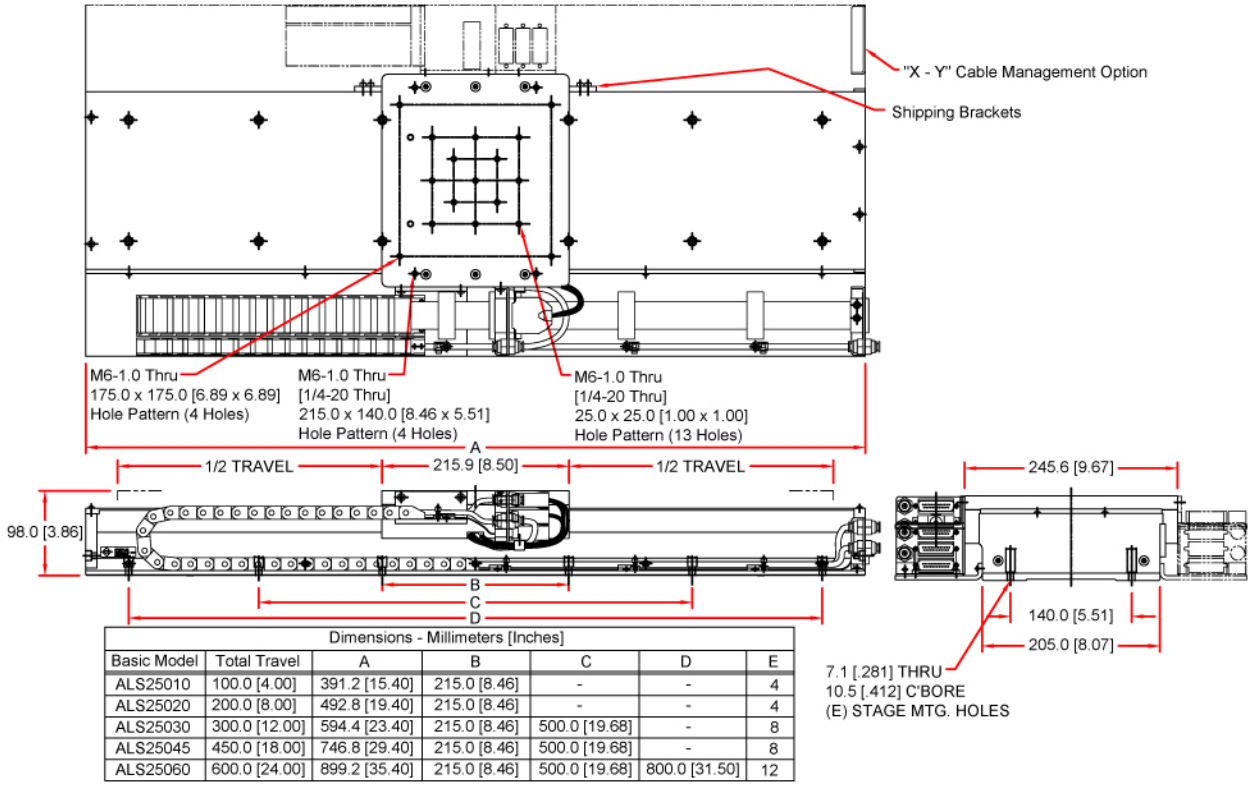
Table 1-1: Model Numbering System

ALS20000 / ALS25000 Series Linear Motor Stage	
ALS20010 / ALS25010	100 mm (4 in) travel stage with linear motor and limits
ALS20020 / ALS25020	200 mm (8 in) travel stage with linear motor and limits
ALS20030 / ALS25030	300 mm (12 in) travel stage with linear motor and limits
ALS20045 / ALS25045	450 mm (18 in) travel stage with linear motor and limits
ALS20060 / ALS25060	600 mm (24 in) travel stage with linear motor and limits
Mounting and Grid Pattern	
-0(1)	No tabletop
-M	Metric dimension mounting pattern and holes
-M/ASR(2)	Metric dimension mounting pattern and holes; mounts ASR rotary stages centered
-U	English dimension mounting pattern and holes
Motor	
-10-S	Brushless linear motor with standard magnet track (BLM-142-A)
-10-P	Brushless linear motor with high performance magnet track (BLM-142-A)
Limits	
-NC	Normally-closed end of travel limit switches (standard)
-NO	Normally-open end of travel limit switches
Standard Linear Encoders	
-LT10AS	Linear encoder for ALS25010; amplified sine output
-LT20AS	Linear encoder for ALS25020; amplified sine output
-LT30AS	Linear encoder for ALS25030; amplified sine output
-LT45AS	Linear encoder for ALS25045; amplified sine output
-LT60AS	Linear encoder for ALS25060; amplified sine output
-LT10X5	Linear encoder for ALS25010; 1.0 micron line driver output
-LT20X5	Linear encoder for ALS25020; 1.0 micron line driver output
-LT30X5	Linear encoder for ALS25030; 1.0 micron line driver output
-LT45X5	Linear encoder for ALS25045; 1.0 micron line driver output
-LT60X5	Linear encoder for ALS25060; 1.0 micron line driver output
High-Accuracy Linear Encoders	
-LN10AS	High-accuracy linear encoder for ALS25010; amplified sine output
-LN20AS	High-accuracy linear encoder for ALS25020; amplified sine output
-LN30AS	High-accuracy linear encoder for ALS25030; amplified sine output
-LN45AS	High-accuracy linear encoder for ALS25045; amplified sine output
-LN60AS	High-accuracy linear encoder for ALS25060; amplified sine output

Table 1-1: Model Numbering System (continued)

Options	
-X-CMS	Cable management system for single axis assembly
-XY-CMS	Cable management system for X-Y assembly; order with X-axis only
-XYZ-CMS	Cable management system for X-Y-Z assembly; order with X-axis only
-XYZT-CMS	Cable management system for X-Y-Z-T assembly; order with X-axis only
-Y-CMS	Cable management system for X-Y assembly; order with Y-axis only
-YZ-CMS	Cable management system for Y-Z assembly; order with Y-axis only
-YZT-CMS	Cable management system for Y-Z-T assembly; order with Y-axis only
Accessories (to be ordered as separate line item)	
HALAR	High-accuracy system — linear error correction for accuracy and repeatability
HALSF	High-accuracy system — improved straightness and flatness
ALIGNMENT-NPA	Non-precision XY assembly
ALIGNMENT-PA10	XY assembly; 10 arc sec orthogonal
ALIGNMENT-PA5	XY assembly; 5 arc sec orthogonal
(1) Only available on the ALS20000 (2) Only available on the ALS25000	

1.2. Dimensions



Dimensions - Millimeters [Inches]

Basic Model	Total Travel	A	B	C	D	E
ALS25010	100.0 [4.00]	391.2 [15.40]	215.0 [8.46]	-	-	4
ALS25020	200.0 [8.00]	492.8 [19.40]	215.0 [8.46]	-	-	4
ALS25030	300.0 [12.00]	594.4 [23.40]	215.0 [8.46]	500.0 [19.68]	-	8
ALS25045	450.0 [18.00]	746.8 [29.40]	215.0 [8.46]	500.0 [19.68]	-	8
ALS25060	600.0 [24.00]	899.2 [35.40]	215.0 [8.46]	500.0 [19.68]	800.0 [31.50]	12

Figure 1-3: ALS20000 / ALS25000 Dimensions

1.3. Safety Procedures and Warnings

The following statements apply throughout this manual. Failure to observe these precautions could result in serious injury to those performing the procedures and damage to the equipment.

This manual and any additional instructions included with the stage should be retained for the lifetime of the stage.

	To minimize the possibility of electrical shock and bodily injury or death, disconnect all electrical power prior to making any electrical connections.
	To minimize the possibility of electrical shock and bodily injury or death when any electrical circuit is in use, ensure that no person comes in contact with the circuitry when the stage is connected to a power source.
	To minimize the possibility of bodily injury or death, disconnect all electrical power prior to making any mechanical adjustments.
	Moving parts of the stage can cause crushing or shearing injuries. All personnel must remain clear of any moving parts.
	Improper use of the stage can cause damage, shock, injury, or death. Read and understand this manual before operating the stage.
	If the stage is used in a manner not specified by the manufacturer, the protection provided by the stage can be impaired.
	Stage cables can pose a tripping hazard. Securely mount and position all stage cables to avoid potential hazards.

Do not expose the stage to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.

The stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.

Use care when moving the stage. Manually lifting or transporting stages can result in injury.

Only trained personnel should operate, inspect, and maintain the stage.

This stage is intended for light industrial manufacturing or laboratory use. Use of the stage for unintended applications can result in injury and damage to the equipment.

Before using this stage, perform an operator risk assessment to determine the needed safety requirements.

1.4. EC Declaration of Incorporation

Manufactorer: Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA 15238
USA

herewith declares that the product:
Aerotech, Inc. ALS20000 / ALS25000 Stage
is intended to be incorporated into machinery to constitute machinery covered by the Directive 2006/42/EC as amended;

does therefore not in every respect comply with the provisions of this directive;

and that the following harmonized European standards have been applied:
EN ISO 12100-1,-2:2003+A1:2009
Safety of machinery - Basic concepts, general principles for design
ISO 14121-1:2007
Safety of machinery - Risk assessment - Par 1: Principles
EN 60204-1:2005
Safety of machinery - Electrical equipment of machines - Part 1: General requirements
and further more declares that
it is not allowed to put the equipment into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provisions of the Directive 2006/42/EC and with national implementing legislation, i.e. as a whole, including the equipment referred to in this Declaration.

Authorized Representative: Manfred Besold
Address: AEROTECH GmbH
Süd-West-Park 90
D-90449 Nürnberg

Name: Alex Weibel /
Position: Engineer Verifying Compliance
Location: Pittsburgh, PA
Date: April 5, 2011

Chapter 2: Installation

This chapter describes the installation procedure for the ALS20000 / ALS25000 stage, including handling the stage properly, preparing the mounting surface to accept the stage, securing the stage to the mounting surface, attaching the payload, and making the electrical connections.

Installation must follow the instructions in this chapter. Failure to follow these instructions could result in injury and damage to the equipment.

2.1. Unpacking and Handling the Stage

Carefully remove the stage from the protective shipping container. Before operating the stage, it is important to let the stage to stabilize at room temperature for at least 12 hours. It is also important to clean the stage by blowing it off with pressurized nitrogen or clean, oil-less air.

All ALS20000 / ALS25000 series stages are packaged with shipping clamps installed to prevent stage table movement. These are red anodized brackets (the only red anodized pieces Aerotech uses) that bolt the stage table to the base. These must be removed before the stage table can be moved.

Each stage has a label listing the system part number and serial number. These numbers contain information necessary for maintaining or updating system hardware and software. Locate this label and record the information for later reference. If any damage has occurred during shipping, report it immediately.

Improper stage handling could adversely affect the stage's performance. Use care when moving the stage. Manually lifting or transporting stages can result in injury.

Do not allow the stage to drop onto the mounting surface.

Lift the stage only by the base. Do not use the stage table as a lifting point.

2.2. Preparing the Mounting Surface

The mounting surface should be flat and have adequate stiffness in order to achieve the maximum performance from the ALS20000 / ALS25000. When an ALS20000 / ALS25000 series stage is mounted to a non-flat surface, the stage can be distorted as the mounting screws are tightened. This distortion will decrease the overall accuracy of the stage. *To maintain accuracy, the mounting surface should be flat within 1µm per 50mm.* Adjustments to the mounting surface must be done before the stage is secured. The effects of flatness on mounting are illustrated in Figure 2-1.

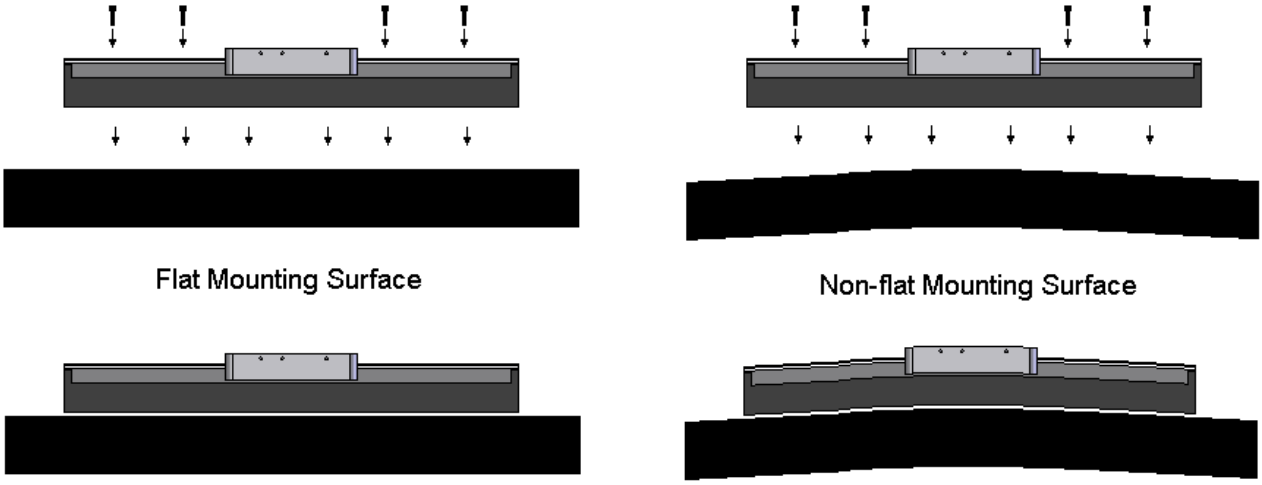


Figure 2-1: Results of Flat Versus Non-Flat Mounting

NOTE: The stage base is precision machined and verified for flatness prior to stage assembly at the factory. If machining is required to achieve the desired flatness, it should be performed on the mounting surface rather than the stage base. Shimming should be avoided if possible. If shimming is required, it should be minimized to improve the rigidity of the system.

2.3. Securing the Stage to the Mounting Surface

To access the mounting holes of the stage, the hardcover must be removed. Four screws, two at each end of the stage, retain the hardcover (see Figure 2-2). Remove the screws and slide the hardcover out from under the table. If necessary, manually move the stage table to access the counter-bored mounting holes along the edges of the stage (refer to Figure 2-3). Install the appropriately sized socket head cap screws (M6 or 1/4") through the mounting holes and secure the stage to the mounting surface.

The stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.

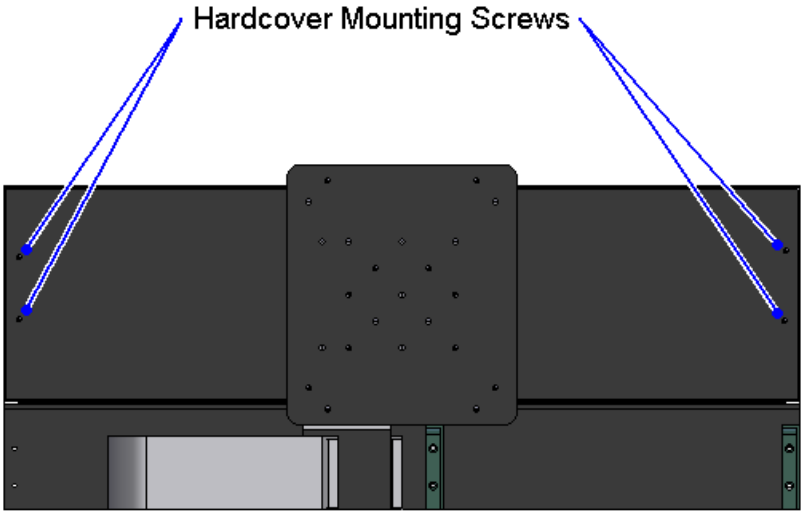


Figure 2-2: Top View of ALS20000 / ALS25000 Stage Showing Hardcover Mounting Screws

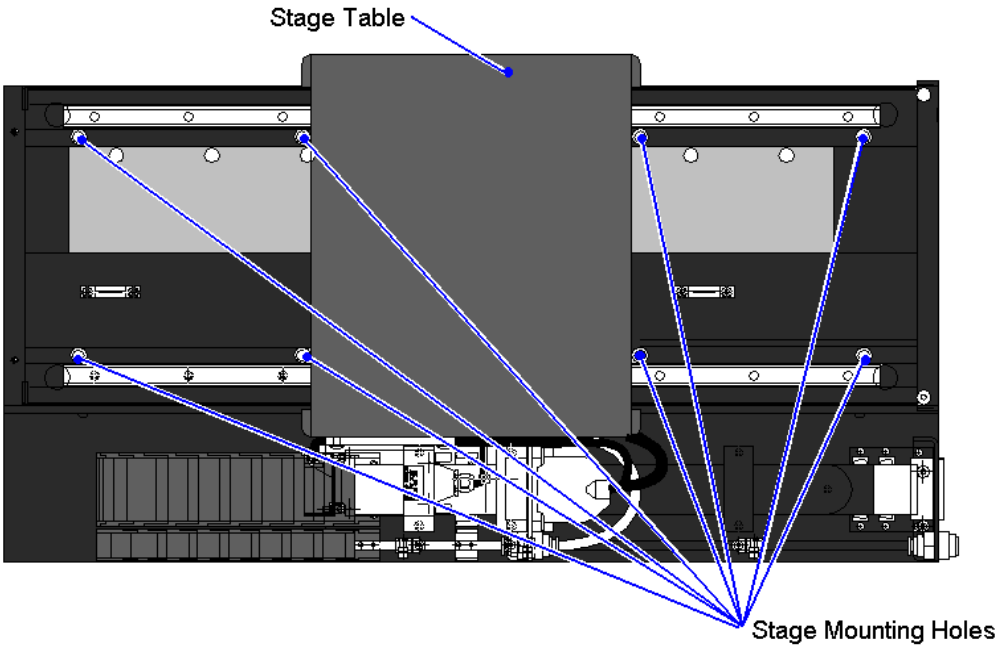


Figure 2-3: Internal View of ALS20000 / ALS25000 Stage Showing Mounting Holes

2.4. Attaching the Payload to the Stage

To prevent damage to payloads, test the operation of the stage before the payload is attached to the stage table. Proceed with the electrical installation and test the motion control system in accordance with the system documentation. Document all results for future reference. For information on electrical connections, refer toSection 2.5.

The payload should be flat, rigid, and comparable to the stage in quality.

NOTE: For valid system performance, the mounting interface should be flat within 1 µm per 25 mm.

Refer to Chapter 3: Operating Specifications for information on cantilevered loads and load positioning.

2.5. Electrical Installation

Electrical installation requirements will vary depending on stage options. Installation instructions in this section are for stages equipped with standard Aerotech motors intended for use with an Aerotech motion control system. Contact Aerotech for further information regarding stages that are otherwise configured .See Section 3.5. for wiring diagrams, connector pin labels, and pin descriptions.

Aerotech motion control systems are adjusted at the factory for optimum performance. When the ALS20000 / ALS25000 series stage is part of a complete Aerotech motion control system, setup involves connecting a stage and motor combination to the appropriate drive chassis with the cables provided. Connect the provided cables to the motor and feedback connectors on the stage. Labels on the drive indicate the appropriate connections. Refer to your drive manuals and documentation for additional installation and operation information. In some cases, if the system is uniquely configured, a drawing showing system interconnects is supplied.

An integral linear motor comes mounted to all ALS20000 / ALS25000 stages. The electrical wiring from the motor, encoder, and limit switches are integrated into two main connectors at the factory. Refer to Section 3.5. for standard motor wiring and connector pin outputs.

Never connect or disconnect any electrical component or connecting cable while power is applied, or serious damage may result.

The stage and motor's protective ground is located on pin A4 of the motor connector. If you are using cables other than those provided by Aerotech to connect the motor to the drive, you must connect pin A4 to a ground connection.

Chapter 3: Operating Specifications

The surrounding environment and operating conditions can affect the performance and service life of the stage. This chapter provides information on ideal environmental and operating conditions. Also included are instructions for estimating load capability given various loading situations.

3.1. Environmental Specifications

The environmental specifications for the ALS20000 / ALS25000 are listed in the following table.

Table 3-1: Environmental Specifications

Ambient Temperature	Operating: 10° to 35° C (50° to 95° F) The optimal operating temperature is 20° C ±2° C (68° F ±4° F). If at any time the operating temperature deviates from 20° C degradation in performance could occur. Contact Aerotech for information regarding your specific application and environment.
	Storage: 0° to 40° C (32° to 104° F) in original shipping packaging
Humidity	Operating: 40 percent to 60 percent RH The optimal operating humidity is 50 percent RH.
	Storage: 30 percent to 60 percent RH, non-condensing in original packaging
Altitude	Operating: 0 to 2,000 m (0 to 6,562 ft) above sea level Contact Aerotech if your specific application involves use above 2,000 m or below sea level.
Vibration	Use the system in a low vibration environment. Excessive floor or acoustical vibration can affect stage and system performance. Contact Aerotech for information regarding your specific application.
Dust Exposure	The ALS25000 stages have limited protection against dust, but not water. This equates to an ingress protection rating of IP50. Due to their side openings the ALS20000 stages have an ingress protection rating of IP10.
Use	Indoor use only

Do not expose the stage to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.

3.2. Basic Specifications

Basic ALS20000 / ALS25000 series positioning stage specifications are shown in Table 3-2. General resolution information is given in Table 3-3 for each type of encoder. Motor specifications are given in Table 3-4.

Table 3-2: ALS20000 / ALS25000 Series Specifications

Basic Model			ALS20010 / ALS25010	ALS20020 / ALS25020	ALS20030 / ALS25030	ALS20045 / ALS25045	ALS20060 / ALS25060
Total Travel			100 mm (4in)	200 mm (8in)	300 mm (12in)	450 mm (18in)	600 mm (24in)
Drive System			Linear Brushless Servomotor (BLM-142-A)				
Feedback			Noncontact Linear Encoder				
Resolution	LN		0.001 µm - 0.2 µm (0.04 µin - 8 µin)				
	LT		0.005 µm - 1.0 µm (0.2 µin - 40 µin)				
Maximum Travel Speed(1)			2 m/s (80 in/s)				
Maximum Linear Acceleration			3 g - 30 m/s2 (1152 in/s2) (no load)				
Maximum Load (2)	Horizontal		70.0 kg (154.3 lb)				
	Side		35.0 kg (77.2 lb)				
Continuous Stall Force(3,4)	Air Cooling (20 psi)		168.0 N (37.9 lb)				
	No Air		109.0 N (24.6 lb)				
Peak Force(4)			673.0 N (151.0 lb)				
Accuracy	LN	HALAR(5)	±1.0 µm (±40 µin)				
		Standard	±5.0 µm (±200 µin)				
	LT	HALAR(5)	±1.0 µm (±40 µin)				
		Standard	±4.0 µm (±160 µin)	±8.0 µm (±320 µin)	±12.0 µm (±480 µin)	±18.0 µm (±720 µin)	±24.0 µm (±960 µin)
Repeatability	LN		±0.5 µm (±20 µin)				
	LT		±0.5 µm (±20 µin))				
Straightness and Flatness	Differential	HALSF	1 µm/25 mm (40 µin/in)				
		Standard	2 µm/25 mm (80 µin/in)				
	Maximum Deviation	HALSF	±1.0 µm (±40 µin)	±1.5 µm (±60 µin)	±2.0 µm (±80 µin)	±2.5 µm (±100 µin)	±3.0 µm (±120 µin)
		Standard	±2.0 µm (±80 µin)	±4.0 µm (±160 µin)	±6.0 µm (±240 µin)	±9.0 µm (±360 µin)	±9.0 µm (±360 µin)
Pitch and Yaw			5 arc sec	8 arc sec	12 arc sec	17 arc sec	20 arc sec
Nominal Stage Weight			13.5 kg (29.8 lb)	17.5 kg (38.6 lb)	21.0 kg (46.3 lb)	27.0 kg (59.5 lb)	32.5 kg (71.7 lb)
Material			Aluminum				
Finish		Stage	Black Anodize				
		Table	Hard Coating (62 Rockwell Hardness Teflon® Impregnated)				

(1) Maximum speed based on stage capability; maximum application velocity may be limited by system data rate and system resolution.
(2) Maximum load based on bearing capability; maximum application load may be limited by acceleration requirements.
(3) Thermal limitations of positioning stage with respect to performance may limit continuous force output.
(4) Force may be limited by amplifier output.
(5) Available with Aerotech controllers.

Table 3-3: ALS20000 / ALS25000 Series Resolution Information

Code	Signal Period	Travel/Step	Multiplier	Maximum Speed	Signal Type
LTAS	20 µm	0.02 µm to 1.0 µm	Requires External	System Data Rate	
LTX5	20 µm	1 µm	Integral x5	2 m/s	
LNAS	4 µm	0.004 µm to 0.2 µm	Requires External	System Data Rate	

Table 3-4: ALS20000 / ALS25000 Motor Specifications

Model		BLM-142
Winding Designation		**-A**
Performance Specifications (1,5)		
Continuous Force, 20 psi, 1.4 bar (2)	N	134.2
	lb	30.2
Continuous Force, No Cooling, (2)	N	85.6
	lb	19.3
Peak Force (3)	N	537.0
	lb	120.7
Electrical Specifications (5)		
BEMF Constant (line to line, max)	V / m / sec	31.75
	V / in / sec	0.81
Continuous Current, 20 psi, 1.4 bar (2)	A, pk	4.86
	A, rms	3.44
Continuous Current, No Cooling (2)	A, pk	3.10
	A, rms	2.19
Peak Current, Stall (3)	A, pk	19.44
	A, rms	13.75
Force Constant, Sinusoidal Drive (4,8)	N / A, pk	27.62
	lb / A, pk	6.21
	N / A, rms	39.06
	lb / A, rms	8.78
Motor Constant (2,4)	N / √W	8.16
	lb / √W	1.84
Resistance, 25 °C (line to line)	Ohms	10.9
Inductance (line to line)	mH	8.70
Thermal Resistance, 20 psi, 1.4 bar	°C / W	0.37
Thermal Resistance, No Cooling	°C / W	0.91
Maximum Bus Voltage	VDC	340

(1) Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
(2) Values shown @ 100 °C rise above a 25 °C ambient temperature, with motor mounted to the specified aluminum heat sink
(3) Peak force assumes correct rms current, consult Aerotech
(4) Force Constant and Motor Constant specified at stall
(5) All performance and electrical specifications +/- 10%
(6) Maximum winding temperature is 125 °C
(7) Ambient operating temperature range: 0 °C - 25 °C, consult Aerotech for performance in elevated ambient temperatures
(8) All Aerotech amplifiers are rated Apk; use torque constant in N-m / Apk when sizing

3.3. Load Capability

It is recommended that application loads be symmetrically distributed whenever possible (i.e., the payload should be centered on the stage table and the entire stage should be centered on the support structure). With the stage lying flat (horizontal) and the application load vertically applied and symmetrically distributed, the maximum vertical load carrying capacity of ALS20000 / ALS25000 stages is 70.0 kg. If cantilevered loads are applied, refer to Figure 3-1 to find the maximum allowable load.

In Figure 3-1, a curve is shown for cantilevered loading conditions. The Lsc or “side cantilever” curve assumes a horizontal stage orientation with the load extended above the table. If a cantilevered load situation is used, measure the cantilever length, then find the corresponding load value from Figure 3-1.

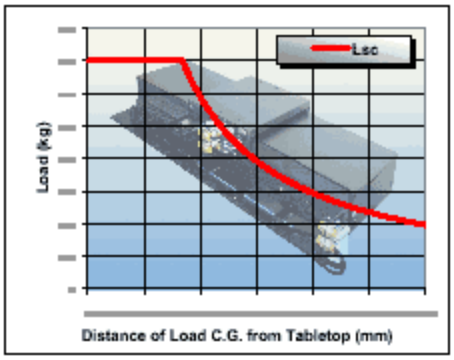


Figure 3-1: Load Capability of ALS20000 / ALS25000 Series Stages

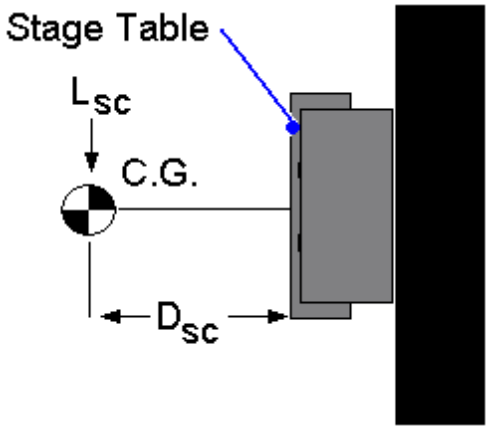


Figure 3-2: Finding L_{SC} for Side-Mounted Stages

The acceleration capability of the ALS20000 / ALS25000 stage will depend on the mass that is mounted to the stage table. Figure 3-3 gives both peak acceleration and continuous acceleration capabilities of the ALS20000 / ALS25000 series stages. Peak accelerations can be reached for small amounts of time, but cannot be sustained. Continuous acceleration specifications should be used when calculating accelerations for processes that require high duty cycles.

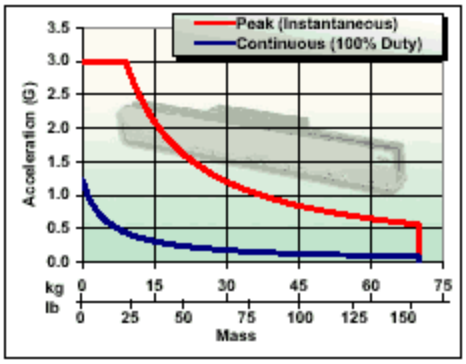


Figure 3-3: Acceleration vs. Mass for ALS20000 / ALS25000 Series Stages

3.4. Optical Limit Switch

ALS20000 / ALS25000 series stages are provided with a pair of optical limit switch assemblies mounted to the bottom of the stage table. The limit switches signal when the stage table has reached its maximum useable travel distance in both directions.

3.4.1. Limit Switch Operation

Each limit switch has a light source and detector mounted to a small printed circuit board. Each limit switch board is mounted at the ends of the stage table with their emitter–detector axes perpendicular to the direction of table motion. When movement of the stage table causes the blade mounted to the stage base to break the light beam from the emitter to the detector, a limit signal is generated. The limit switch itself can be configured as normally closed (NC) or normally open (NO).

If the stage is driven approximately 8 mm beyond the electrical limit, it will encounter a mechanical stop. Although the operating speed of the stage may be relatively slow, damage to the stage could result.

3.4.2. Limit Switch Wiring

Limit switches are open-collector, TTL–compatible, electro–optical devices powered by 5 Volts that change output states when the stage approaches its maximum travel distance and breaks the light beam. Since they are open-collector devices, they may be interfaced to 24V logic inputs. Each limit switch is mounted on a small printed circuit board. Standard ALS20000 / ALS25000 Stages include limit switch wiring integrated into one of the two main connectors.

Assuming a NC limit configuration, the input to the controller is seen as a logic 0 (typical 0.4V @ 12.8mA) when no limit condition is present. When the limit switch is activated, a 5V source through a pull-up resistor causes a logic 1 (typically 4.8-5V) to be seen by the controller input. The limit switch operation for a NO limit configuration is the exact opposite as described above. See Figure 3-4 for a diagram of limit switch wiring.

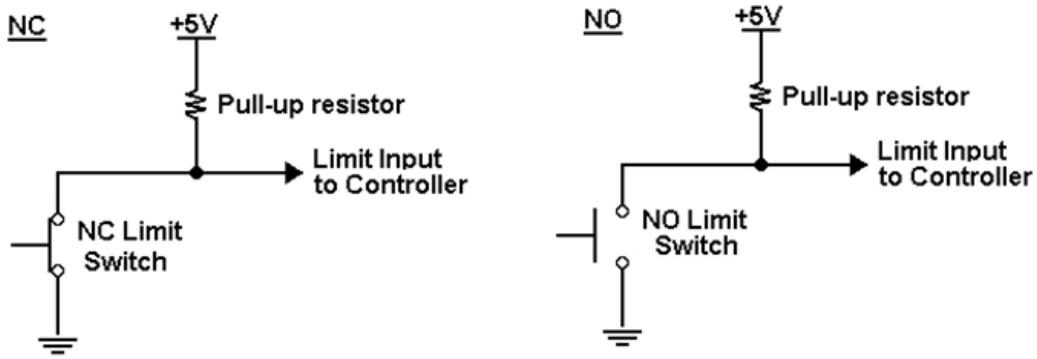


Figure 3-4: Normally Closed (NC) and Normally Open (NO) Limit Switch Wiring

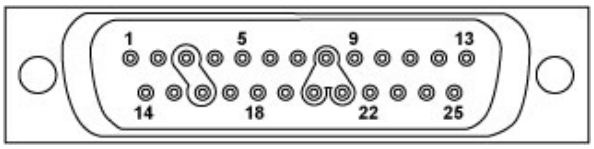
3.5. Standard Motor Wiring

Stages come from the factory completely wired and assembled. For reference, connector pin outputs (pin-outs) and general wiring information is given in the following figures. Pinouts are defined in Table 3-8.

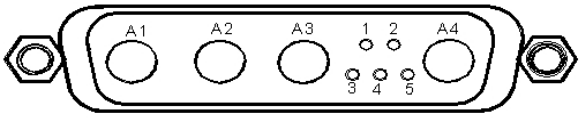
NOTE: Refer to the other documentation accompanying your Aerotech equipment. Call your Aerotech representative if there are any questions on system configuration.

NOTE: If you are using your own cables to connect the stage, ensure that motor and ground wires can handle current higher than the continuous current listed in Table 3-4. The voltage rating of the wire insulation must be greater than the bus voltage listed in Table 3-4.

Table 3-5: Feedback and Motor Connectors for Stages with LT Square Wave Encoders

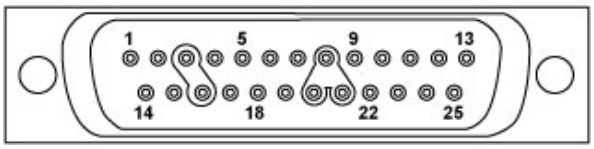


Pin	Description	Pin	Description
1	SIG SHLD	14	COS
2	THERM SW	15	COS-N
3	ENC +5V	16	LMT +5V
4	SIG COM	17	SIN
5	HB	18	SIN-N
6	MKR-N	19	RESERVED
7	MKR	20	SIG COM
8	RESERVED	21	SIG COM
9	SETUP	22	HM LMT-N
10	HA	23	ERROR -
11	HC	24	-LMT
12	+LMT	25	RESERVED
13	RESERVED		

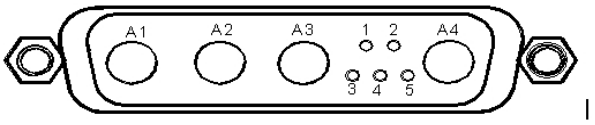


Pin	Description	Pin	Description
A1	MTR ØA	3	RESERVED
A2	MTR ØB	4	RESERVED
A3	MTR ØC	5	RESERVED
1	MTR SHLD	A4	FRM GND
2	RESERVED		

Table 3-6: Feedback and Motor Connectors for Stages with LT Amplified Sine Encoders

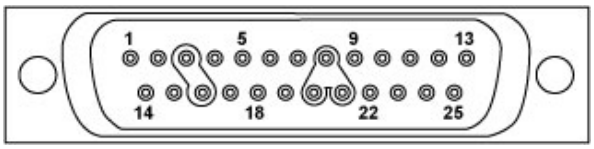


Pin	Description	Pin	Description
1	SIG SHLD	14	COS
2	THERM SW	15	COS-N
3	ENC +5V	16	LMT +5V
4	SIG COM	17	SIN
5	HB	18	SIN-N
6	MKR-N	19	RESERVED
7	MKR	20	SIG COM
8	RESERVED	21	SIG COM
9	SETUP	22	HM LMT-N
10	HA	23	ERROR -
11	HC	24	-LMT
12	+LMT	25	RESERVED
13	RESERVED		

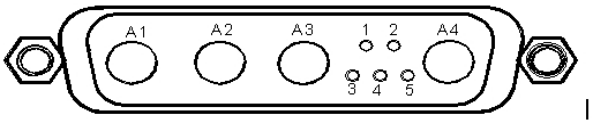


Pin	Description	Pin	Description
A1	MTR ØA	3	RESERVED
A2	MTR ØB	4	RESERVED
A3	MTR ØC	5	RESERVED
1	MTR SHLD	A4	FRM GND
2	RESERVED		

Table 3-7: Feedback and Motor Connectors for Stages with LN High Accuracy Encoders



Pin	Description	Pin	Description
1	SIG SHLD	14	COS
2	THERM SW	15	COS-N
3	ENC +5V	16	LMT +5V
4	RESERVED	17	SIN
5	HB	18	SIN-N
6	MKR-N	19	RESERVED
7	MKR	20	SIG COM
8	RESERVED	21	SIG COM
9	RESERVED	22	HM LMT-N
10	HA	23	RESERVED
11	HC	24	-LMT
12	+LMT	25	RESERVED
13	RESERVED		



Pin	Description	Pin	Description
A1	MTR ØA	3	RESERVED
A2	MTR ØB	4	RESERVED
A3	MTR ØC	5	RESERVED
1	MTR SHLD	A4	FRM GND
2	RESERVED		

Table 3-8: Motor Wiring Pinout Descriptions

Pin Output	Description
+LMT	Active high signal indicating maximum travel produced by positive stage direction.
COS	Cosine. Incremental encoder output; either TTL line driven or amplified sine wave type signal.
COS-N	Incremental encoder output. Complement of cos.
-LMT	Active high signal indicating stage maximum travel produced by negative stage direction.
ENC +5V	+5 V supply input for optical encoders. Typical requirement is 250 mA.
HA	Hall Effect A. Brushless motor commutation track output. TTL line driven signal with rotary motor.
HB	Hall Effect B. Brushless motor commutation track output. TTL line driven signal with rotary motor.
HC	Hall Effect C. Brushless motor commutation track output. TTL line driven signal with rotary motor.
LMT +5v	+ 5 V supply input for optical limit switch boards. Typical requirement is 50 mA.
MKR	Marker. Incremental encoder output pulse given once per revolution. Typically used for home reference cycle.
MKR-N	Incremental encoder output; either the compliment of Marker with a line driven, TTL type encoder or 2.5 V DC bias level with amplified sine wave type encoder.
SIN	Sine. Incremental encoder output; either TTL line driven or amplified sign wave type signal.
SIN-N	Incremental encoder output. Complement of sin.
MTR ØA	Motor Phase A.
MTR ØB	Motor Phase B.
MTR ØC	Motor Phase C.
RESERVED	Not used.
SIG SHLD	Feedback connector shield.
THERM SW	Positive lead for motor thermistor (to motion controller).
SIG COM	Common ground for feedback connector wiring..
HM LMT-N	Home Limit. Paralleled with -LMT (with Standard Jumper) or +LMT (Optional Jumper) limit. Typically not used.
SETUP	Analog output that represents quality of encoder signal, used for troubleshooting and setup. LT encoders only.
MTR SHLD	Shield for motor connector wiring.
FRM GND	Motor common ground.
ERROR -	Active high TTL output that represents encoder failure or misalignment. LT encoders only.

3.6. Vacuum Operation

Please contact Aerotech for information regarding operation in a vacuum environment.

Chapter 4: Maintenance

It is necessary to keep the linear bearing rails properly lubricated. Without proper lubrication, excessive wear will cause premature failure of the bearings. This will seriously degrade overall performance of the stage.

This chapter will cover information about intervals between lubrications, detail the lubrication and inspection process, and cover which lubricants are recommended for use.

NOTE: The bearing area must be kept free of foreign matter and moisture; otherwise, the performance and life expectancy of the stage will be reduced.

To minimize the possibility of bodily injury, confirm that all electrical power is disconnected prior to making any mechanical adjustments.

4.1. Service and Inspection Schedule

Lubricant inspection and replenishment in ALS20000 / ALS25000 series stages depends on conditions such as duty cycle, speed, and the environment. An inspection interval of once per month is recommended until a trend develops for the application. Longer or shorter intervals may be required to maintain the film of lubricant on the bearing surfaces. In general, it is recommended that stages operating in a clean environment be lubricated annually. For stages operating under conditions involving excessive debris, lubrication every six months is recommended. The motor is completely non-contact and requires no lubrication.

4.2. Cleaning and Lubrication

4.2.1. Recommended Lubricants and Cleaning Solvents

For standard linear bearing guide rails, NSK LGU grease is recommended.

If a solvent is necessary for cleaning the stage, it is recommended that isopropyl rubbing alcohol be used. Harsher solvents, such as acetone, may damage the plastic and rubber seals on the linear bearing trucks.

For high-speed applications (i.e., near maximum speed at a duty cycle of 50%), frequent maintenance with standard lubricants is required.

4.2.2. Important Notes on Lubrication

When cleaning and/or lubricating components of the ALS25000 series stages:

1. Be sure to use a clean, dry, soft, and lint–free cloth for cleaning.
2. Take the opportunity during the lubrication procedure to inspect the linear motion guides for any damage or signs of wear.
3. In applications that have multiple stages bolted together to form multi axis systems, the orthogonality may be lost if the stage tables of the support stages are loosened. Precision aligned stages should not be loosened or disassembled.

4.2.3. Lubrication and Cleaning Process

The lubrication and cleaning process is outlined in the steps that follow.

1. Drive the stage table to one end of travel and remove power to the stage.
2. Remove the screws on the edges of the hard cover (as shown in Figure 4-1) and slide it out from under the stage.
3. Remove any accumulated dust or debris from the inside of the assembly.
4. Remove any dirty or dried lubricant from the linear bearing rails. Use a clean, lint-free cloth with a side-to-side motion. A swab soaked in Isopropyl Alcohol may be used to remove stubborn debris.
5. Apply a thin, continuous film of lubricant to the linear bearing guides. A good quality, natural bristle artist's brush makes an excellent applicator.
6. Manually move the stage to the opposite end of travel. This will work the grease into the linear bearing guides. The stage table should move freely with little resistance.
7. Repeat steps 3 through 5 for any areas covered by the original table position.
8. Refasten the hardcover.
9. Restore power to the stage and drive the stage table back to its original position to redistribute lubricants.

To minimize the possibility of bodily injury, confirm that all electrical power is disconnected prior to making any mechanical adjustments.

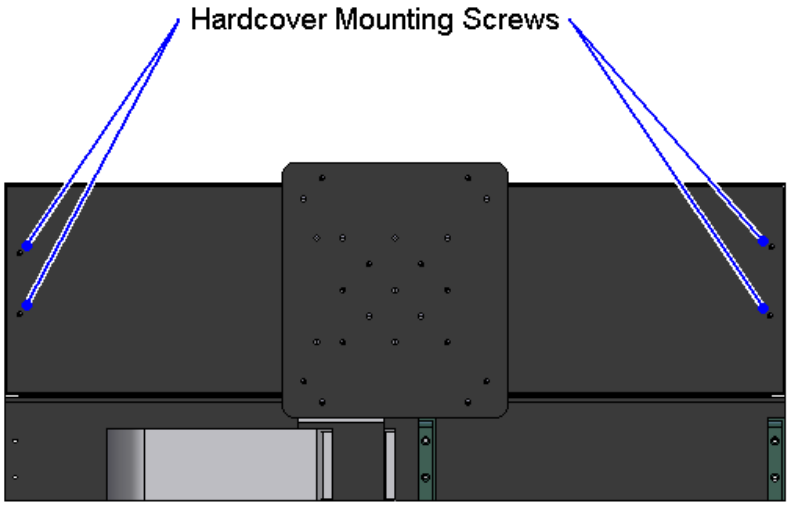


Figure 4-1: Top view of ALS20000 / ALS25000 Stage Showing Hardcover Mounting Screws

Appendix A: Warranty and Field Service

Aerotech, Inc. warrants its products to be free from defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products that are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, where or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability or any claim for loss or damage arising out of the sale, resale or use of any of its products shall in no event exceed the selling price of the unit.

Laser Products

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures.

Return Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than (30) days after the issuance of a return authorization number will be subject to review.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warranted defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an airfreight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Returned Product Non-warranty Determination

After Aerotech's examination, the buyer shall be notified of the repair cost. At such time, the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty-related, then the following policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material. If service is rendered at times other than normal work periods, then special service rates apply.

If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following "On-Site Non-Warranty Repair" section apply.

On-site Non-warranty Repair

If any Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

Company Address

Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA
15238-2897

Phone: (412) 963-7470

Fax: (412) 963-7459

Appendix B: Technical Changes

Table B-1: Current Changes (1.03.00)

Section(s) Affected	General Information
Section 3.5.	Changed pin 8 to reserved

Table B-2: Archived Changes

Revision	Section(s) Affected	General Information
1.00.00	--	New Manual
1.01.00	Section 1.2.	Added Dimensions section
1.02.00	Section 1.4.	Added section
1.02.00	Section 3.1.	Added section
1.02.00	Chapter 2: Installation, Section 2.1. , Section 2.3. , Section 2.5. , and Section 1.3.	Added safety information and warnings
1.02.00	Section 3.2.	Added motor specifications
1.02.00	Section 3.5.	Added note about motor wire current and voltage requirements

Index

A

Attaching the Payload....13

C

cable....13

Cleaning....25

D

Declaration of Incorporation....8

Dimensions....5

E

Electrical Installation....13

Environmental Specifications....15

I

Important Notes on Lubrication....25

Inspection Schedule....25

L

Lubrication....25

Lubrication and Cleaning Process....26

O

Optical Limit Switch....20

P

Preparing the Mounting Surface....10

R

Recommended Lubricants and Cleaning Solvents....25

S

safety procedures....6

Securing the Stage to the Mounting Surface....11

Specifications....16

Standard Features....2

Standard Motor Wiring....21

U

Unpacking and Handling the Stage....9

W

Warnings....6

Reader's Comments

ALS20000 / ALS25000 Series Stage Manual **P/N: EDS100, April 5, 2011** **Revision 1.03.00** Please answer the questions below and add any suggestions for improving this document.	

Is the manual:	Yes	No
Adequate to the subject		
Well organized		
Clearly presented		
Well illustrated		

How do you use this document in your job? Does it meet your needs? What improvements, if any, would you like to see? Please be specific or cite examples.

	Stage/Product Details		Name	
Model #			Title	
Serial #			Company Name	
Date Shipped			Address	
Customer Order #				
Aerotech Subsidiary Order #			Email	

Mail your comments to:	**Fax to:**
Aerotech, Inc. 101 Zeta Drive Pittsburgh, PA 15238 U.S.A.	412-967-6870
	Email:
	service@aerotech.com